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SPECIFICATION FOR MATERIAL FOR ALLOY CAST IRON VALVE SEAT INSERTS

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Indian Standard

SPECIFICATION FOR MATERIAL FOR ALLOY CAST IRON VALVE SEAT INSERTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 October 1979, after the draft finalized by the Cast Iron and Malleable Cast Iron Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 In certain engine applications, to achieve a satisfactory endurance level, seat inserts are required. The inserts are usually press or shrink, fitted into the cylinder head. Combustion deposits, coupled with high temperature and corrosion necessitate the use of seat inserts in order to maintain a good seating surface and, thereby, extend valve life. Seat inserts offer some property not satisfied by conventional structural casting materials, such as resistance to abrasion, hot hardness and corrosion resistance.

0.3 Valve seat inserts are metallic rings produced by an appropriate casting method and are installed on the cylinder head of an engine to provide mating surfaces for the valve during operation. These inserts are replaceable when they are worn out during service. They also offer endurance to critical service conditions required near the inlet and exhaust valves.

0.3.1 The primary requirements for the valve seat inserts are resistance to deformation, corrosion, abrasion and impact at high temperature. A wide range of materials is utilized for seat inserts, for example, alloy cast iron, alloy steel or hard faced alloy steel. The final material selection is influenced by the type of engines, size, output and particular field application. For economy, however, alloy cast iron is preferred. Need has, therefore, been felt to cover the requirements of this material in a standard.

0.4 The dimensional and other requirements for finished valve seat inserts shall be covered by an Indian Standard Specification for valve seat inserts for IC engines (*under preparation*).

0.5 In the preparation of this standard assistance has been derived from SAE J 610 b – Valve seat inserts – engine, issued by the Society of Automotive Engineers.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final vaule, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the material requirements for alloy cast iron valve seat inserts for internal combustion engines.

1.2 The various materials covered by this standard are not recommended for use for applications where the exhaust temperature exceeds 600°C.

2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of material for valve seat inserts shall be as laid down in IS : 1387-1967†.

2.2 The castings from which the inserts are subsequently machined, shall be heat treated, if required, in such a manner so as to fulfil the requirements of microstructure and hardness as described in **6** and **7**.

3. MANUFACTURE

3.1 The melting practices shall be optional to the manufacturers.

3.2 The castings shall be produced either by sand cast, shell moulding, permanent mould, investment or by centrifugal casting methods as agreed to between the purchaser and the manufacturer.

4. GRADES

4.1 There shall be 9 grades of material as given in Table 1.

5. CHEMICAL COMPOSITION

5.1 The material for various grades when analysed in accordance with IS : 228-1959‡ shall have the chemical composition as specified in Table 1.

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*Rules for rounding off numerical values (*revised*).

† General requirements for the supply of matallurgical materials (*first revision*).

‡ Methods of chemical analysis of pig iron, cast iron, plain carbon and low alloy steels (*revised*).

TABLE 1 CHEMICAL COMPOSITION OF INSERT MATERIALS

(*Clause* 5.1)

Grade	Constituent, Percent								
	Carbon	Silicon	Manganese	Chromium	Nickel	Molybdenum	Copper	Sulphur, *Max*	Phosphorus, *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	2·6-2·8	1·6-1·8	0·75 *Max*	2·8-3·2	—	4·0-5·0	—	0·08	0·20
2	3·0-3·25	2·2-2·4	—	0·2-0·4	—	—	—	0·08	0·20
3	0·8-1·00	2·4-2·6	0·75 *Max*	3·0-5·0	—	8·0-9·0	—	0·08	0·20
4	1·4-1·6	1·2-1·4	0·60 *Max*	20·0-22·0	1·2-1·4	—	—	0·08	0·20
5	3·50-3·80	2·20 *Max*	0·7-1·20	1·20-1·50	—	1·20-1·50	—	0·08	0·20
6	1·5-2·0	1·5-2·0	0·5-1·0	13·5-15·0	—	0·35-0·50	—	0·08	0·20
7	1·8-2·0	0·8-1·0	0·60 *Max*	12·0-13·0	—	2·0-2·50	—	0·08	0·20
8A	1·6-1·8	2·4-2·6	1·50 *Max*	2·2-2·5	14·0-16·0	—	6·0-7·0	0·08	0·20
8B	2·4-3·0	2·4-2·6	1·50 *Max*	2·2-2·5	14·0-16·0	—	6·0-7·0	0·08	0·20

6. HARDNESS TEST

6.1 The brinell hardness for the various grades of the castings when carried out in accordance with the method given in IS : 1789-1961* shall conform to the requirements given in Table 2.

7. HEAT TREATMENT AND MICROSTRUCTURE

7.1 The recommended heat treatment and microstructure for the various grades of casting shall be as specified in Table 2.

8. FREEDOM FROM DEFECTS

8.1 The castings shall be free from harmful defects, such as cavities, blow holes, cracks, etc, which may affect the machining and end-use properties. The repair of any such defects shall not be permissible.

9. RETEST AND REJECTION

9.1 If a sample selected for testing fails to meet the requirements specified under **5**, **6** and **7**, the purchaser shall select two further samples from the same cast. If on testing, either of the samples fails to meet the specified requirements, the whole lot would be deemed as not complying with the standard.

10. WORKMANSHIP AND FINISH

10.1 The castings shall conform to the dimensions and drawings furnished by the purchaser.

11. RECOMMENDED APPLICATION

11.1 The recommended applications for the various grades of inserts castings are given in Table 2.

12. PACKING

12.1 The castings shall be suitably packed as agreed to between the purchaser and the manufacturer.

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*Method for Brinell hardness test for grey cast iron.

TABLE 2 PHYSICAL PROPERTIES AND RECOMMENDED APPLICATIONS FOR VALVE SEAT INSERT CASTINGS

(*Clauses* 6.1, 7.1 *and* 11.1)

GRADE (1)	SUPPLY CONDITION (2)	HARDNESS *HB* (3)	MICROSTRUCTURE (4)	RECOMMENDED APPLICATIONS (5)
1	As cast/annealed	277-321	Pearlitic matrix with uniformly distributed carbides	Light duty
2	As cast/stress relieved	187-255	Pearlitic matrix with fine flake graphite	Light duty
3	Annealed/quenched and tempered	302-405	Pearlitic or sorbitic matrix with fine uniformly distributed carbides	Moderate duty
4	Annealed/quenched and tempered	255-321	Pearlitic or sorbitic matrix with fine uniformly distributed carbides	Moderate duty
5	i) As cast/stress relieved	255-321	Pearlitic matrix with fine flake graphite	Medium-heavy duty
	ii) Quenched and tempered	377-460	Tempered martensitic matrix with fine flake graphite	Medium-heavy duty
6	Quenched and tempered	377-460	Pearlitic or sorbitic matrix with fine chromium carbides uniformly distributed in the matrix	Medium-heavy duty
7	Annealed/quenched and tempered	277-355	Pearlitic or sorbitic matrix with fine uniformly distributed carbides	Medium-heavy duty
8A	As cast/stress relieved	187-221	Austenitic matrix with uniformly distributed carbides. Some graphite flakes may be present	Moderate duty for air cooled aluminium alloy cylinder heads
8B	As cast/stress relieved	140-170	Austenitic matrix with uniformly distributed carbides and fine flake graphite	Moderate duty for air cooled aluminium alloy cylinder heads

NOTE — Castings with hardness value other than those specified above may be supplied subject to mutual agreement between the purchaser and the manufacturer.

13. MARKING

13.1 The packages containing the castings shall be legibly marked with the following:

- a) Manufacturer's name or trade-mark;
- b) Grade of the material;
- c) Batch number, if any; and
- d) Any other mark required by the purchaser.

13.1.1 The packages may also be marked with the ISI Certification Mark.

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